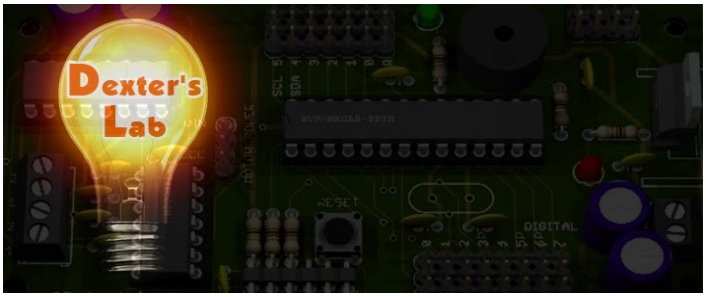

http://dexterslabgr.blogspot.com

GRoboduino
User Manual

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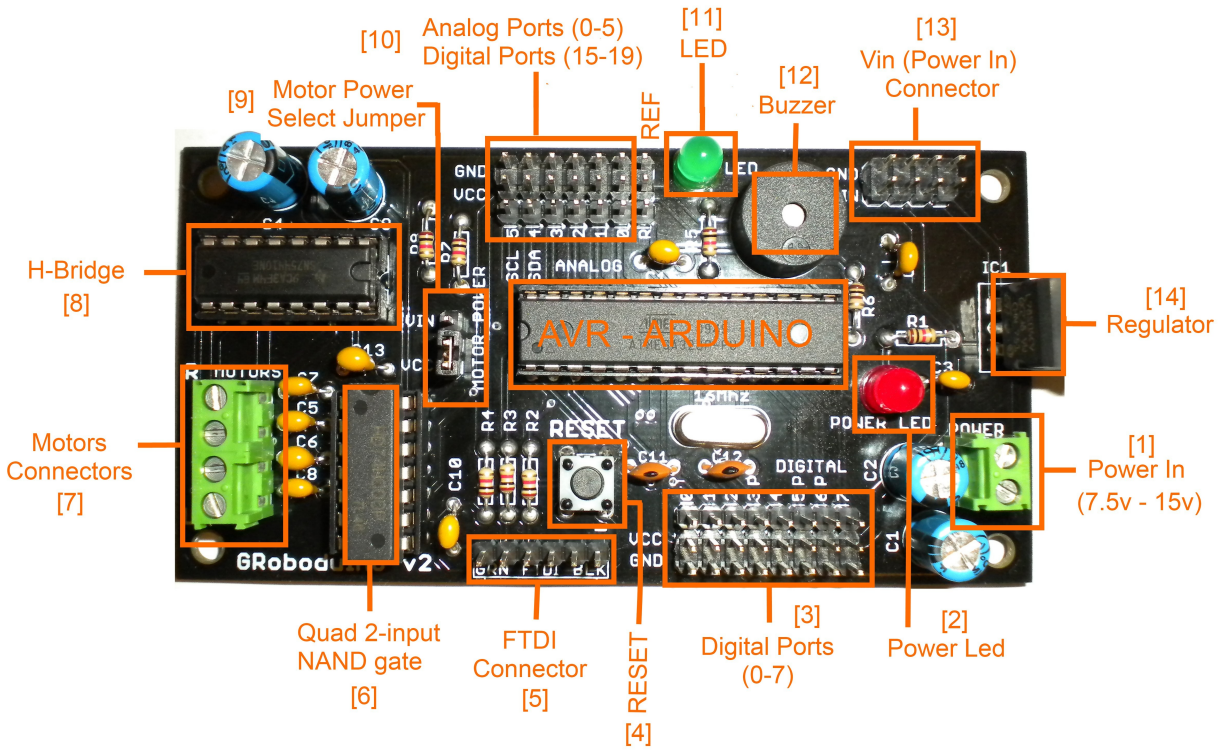
General Description

GRoboduino is a robotics motherboard based on Arduino / AVR processor, featuring many on-board peripherals.

It is designed for beginners who need an easy-to-start-with platform for their first robot, as well as experienced users who want a complete and stable solution (hardware + software library), to base their more complex projects.

Features

- **Processor:** ATMega328 @ 16MHz, pre-loaded with Arduino Bootloader
- **Motor Controller:** Dual H-Bridge, 600mA / motor (1.2A peak)
- **Sound:** Generic Buzzer (on Pin 10)
- **Leds:** Power LED and Programmable LED on Pin 13
- **Analog Pins:** 6
- **Digital Pins:** 8 – 14 (depending on how the analog ports are used)
- **All pins are servo-compatible**
- **Motor Connections:** Screw Terminals
- **Power Supply:** On Board 78S05 (IN: 7.5v – 15v, OUT: 5v, 2A)
- **Motor Power Supply:** User configurable, power from internal regulator (Vcc = 5v, 2A) or Power In (Vin = 7.5v - 15v)
- **FTDI Connector**
- **Arduino Library for all peripherals**



1) **Power In:** This is the screw terminal where you attach your power source. That can be any battery or power supply 7.5v to 15v. Note that you should have the power source attached to the board even during programming, due to USB protecting measures.

2) **Power Led:** It is on if power is applied correctly on GRoboduino.

3) **Digital Ports (0-7):** General Purpose digital ports for use with sensors, servos, relays etc. Ports 0, 1 are also connected to the hardware serial port of AVR processor.
   Ports 3, 5, 6 are capable of use with hardware PWM (analogWrite command of Arduino)

4) **Reset Button:** Used rarely, in cases the processor has to be restarted manually.

5) **FTDI Connector:** This is where your FTDI is connected. FTDI is a usb-to-serial converter, used to connect the on-board serial port to the USB port of a PC, to program the Arduino or for debugging / communication purposes. For standalone applications this is used only during programming.

6) **Quad 2-input NAND Gate:** This IC is used in-circuit between the processor and the H-Bridge so that the connection requires less pins. This is used internally and you will never need to worry about it.

7) **Motor Connector:** Screw terminals for connecting the motors. “L” and “R” marks on the PCB are for Left and Right motor accordingly.

8) **H-Bridge:** Dual H-Bridge, 600mA / motor (1.2A peak), L293DNE. For information on how to use motors / h-bridge easily with the GRoboduino Library, skip to the section “Using GRoboduino Library”.

9) **Motor Power Select Jumper:** This jumper sets the power supply for the motors. You have two choices: Vcc (5v, from the on-board regulator, maximum 2A) or Vin (7.5v-15v, from the Power In of the board). Warning: If you remove the jumper, the motors will not function at all.

10) **Analog Ports (0-5), Digital Ports (15-19):** These ports can be used for analog sensors (using the analogRead command of Arduino). They are connected to the Analog-to-Digital converter of the AVR. There is also a REF pin to be used for setting a reference voltage other than the AVR's standard reference, if that is necessary.
    Alternatively, these ports can be used as digital ports.

11) **LED:** This is the LED you find in every Arduino board, connected on Pin 13. The GRoboduino Library contains commands for manipulating the led with great ease, like “toggleLed”, “setLed”. Find more information about these commands in the “Using GRoboduino Library” section.

12) **Buzzer:** This is a generic Buzzer used for making sounds or music. The GRoboduino Library contains commands like “beep”, “playNote” for the buzzer. Find more information about these commands in the “Using GRoboduino Library” section.

13) **Vin – Power In Connector:** These pins are very useful in those cases when you need to supply another pcb with the power source you are supplying the GRoboduino and you don't want to cut and solder new cables. For example, when using a 12v relay, and you supply GRoboduino with 12v, you can use these pins to supply the transistor-relay pcb with 12v.

14) **Regulator:** 78S05 regulator. It gets voltages from 7.5v - 15v and converts them to stable 5v, up to 2A. Warning: when you use sensors / servos etc that draw more than 1A, it is strongly recommended to attach a heatsink on the regulator! Also, never touch the regulator, it can get very hot!

Getting Started:

Requirements:

- **Arduino IDE (http://www.arduino.cc)** (or alternative)
- **FTDI**
- a **Battery** / **Power Supply** (7.5v – 15v)
- **GRoboduinoBoard Arduino Library**
  (download from http://dexterslabgr.blogspot.com)

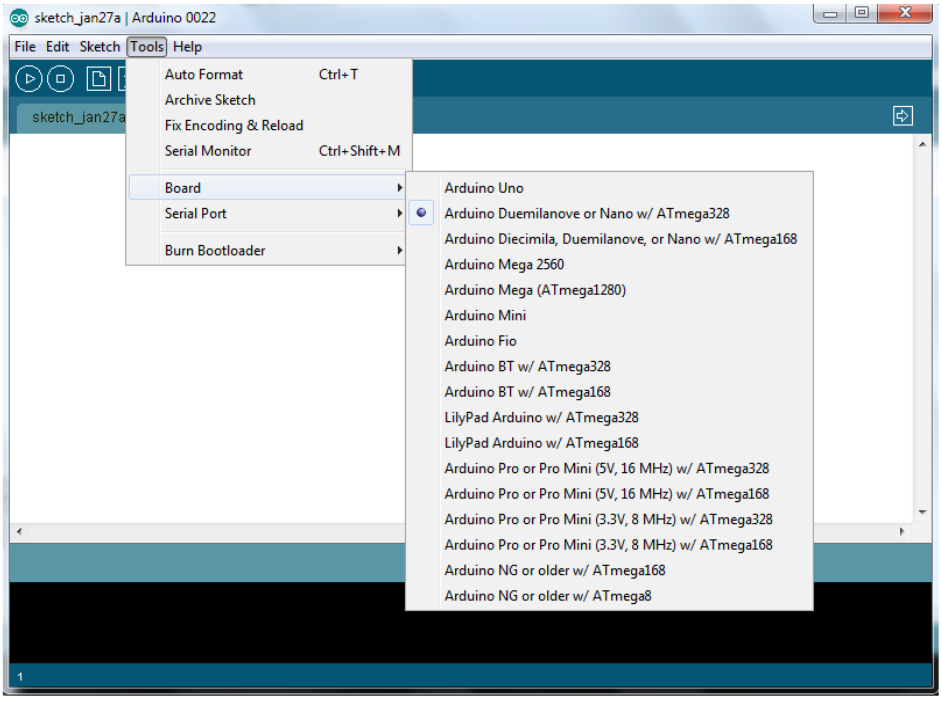
1. **Install** GRoboduinoBoard Library (extract "GroboduinoBoard" folder from the archive to the "libraries" folder of your Arduino IDE installation)
2. **Connect** your FTDI on the "FTDI Connector" of GRoboduino and of course your USB.
3. **Connect** your power source (7.5v – 15v) on the "Power In" screw terminals.
4. If you are using **motors** (hooked up on the "Motors Connectors" screw terminals) do not forget to select the power source of the motors (by using "Motor Power Select Jumper")

Warnings:

- When applying loads exceeding 1A, putting a heatsink on the regulator is strongly recommended.
- Power from USB has been disabled to protect the port. That means, you need to apply power to the GRoboduino even during programming.
- If you remove the "Motor Power Select Jumper" the motors will not function. You must select between Vcc (5v) or Vin (Power In).

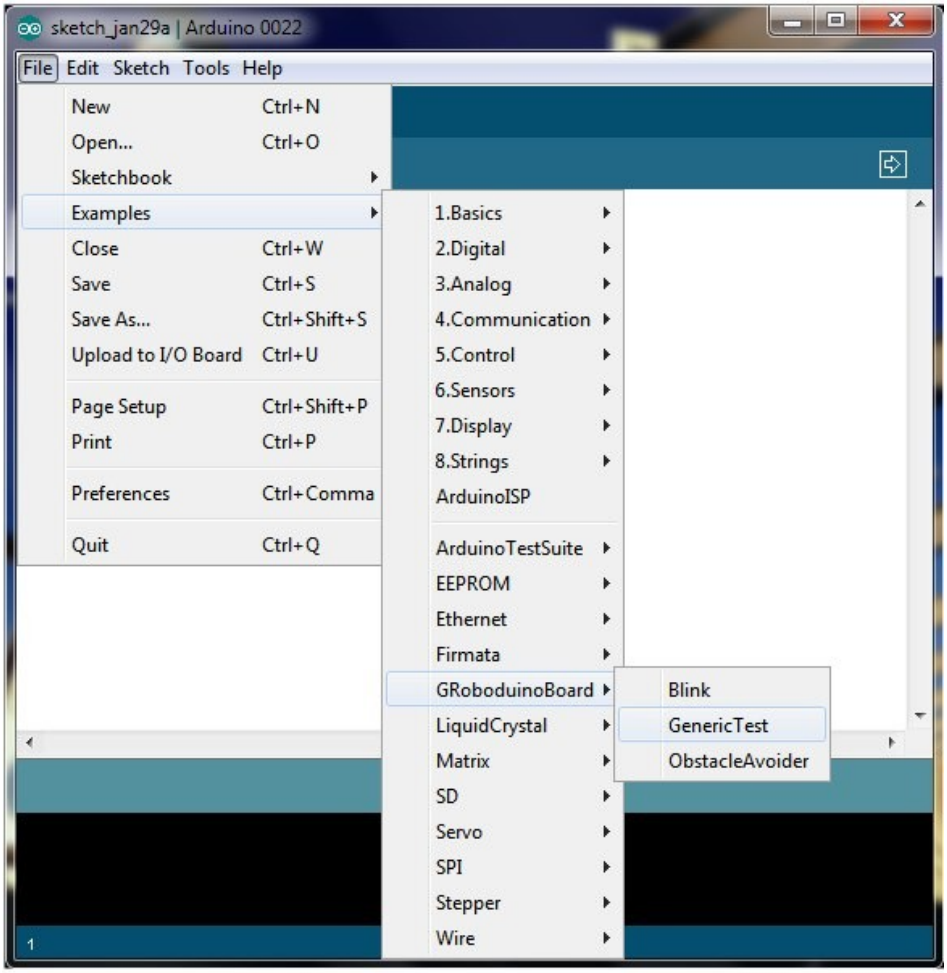
Inside Arduino IDE:

➔ Select "Arduino Duemilanove with ATMega328" Board


sketch_jan27a | Arduino 0022
File Edit Sketch Tools Help
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Serial Monitor Ctrl+Shift+M
Board
Serial Port
Burn Bootloader
Arduino Uno
Arduino Duemilanove or Nano w/ ATmega328
Arduino Diecimila, Duemilanove, or Nano w/ ATmega168
Arduino Mega 2560
Arduino Mega (ATmega1280)
Arduino Mini
Arduino Fio
Arduino BT w/ ATmega328
Arduino BT w/ ATmega168
LilyPad Arduino w/ ATmega328
LilyPad Arduino w/ ATmega168
Arduino Pro or Pro Mini (5V, 16 MHz) w/ ATmega328
Arduino Pro or Pro Mini (5V, 16 MHz) w/ ATmega168
Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega328
Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega168
Arduino NG or older w/ ATmega168
Arduino NG or older w/ ATmega8

➔ Select the Serial Port that was assigned on your FTDI

➔ You can try one of the examples (Blink, GenericTest, ObstacleAvoider).
Even the “Blink” example can teach you many things about how you can use the GRoboduino peripherals easily.



Using The GRoboduinoBoard Library

Let's take for instance the “GenericTest” example:

```
#include "GRoboduinoBoard.h"

GRoboduino brd;

void setup()
{
        Serial.begin(9600);
        Serial.println("GRoboduinoBoard v1.2 GenericTest Example");
        Serial.println("---------------------------------------");

        brd.setLed(ON);
        Serial.println("Led is now on");

        brd.beep();
        Serial.println("Buzzer just beeped");

        brd.initMotors();
        Serial.println("Motors are now initialized");

        brd.setMotors(150, 150);
        Serial.println("Motors should be running forward now with 150 speed");
}

void loop()
{

}
```

Explanation:

- ✓ First of all you need to include the "GroboduinoBoard.h"
- ✓ Create a variable of type “GRoboduino”. That variable is actually your board – with methods (commands) for all the peripherals.
- ✓ If you want to use the motor controller, in the “setup” section of your program you need to initialize the asynchronous motor controller handler with the method “initMotors()” (in this example, the GRoboduino variable is called “brd”, so you can see the command written as “brd.initMotors()”). After that you can set the speed and direction of the motors, and keep them running without any delays in your main loop - the interrupt code that is responsible for the PWM of the motors is as optimized as it gets!

GRoboduino Methods / Commands:

So, these are the class methods of GRoboduino class.
If you don't know what a class method is, then what you should keep in mind is, that the following commands are used after the variable name of the GRoboduino and a dot (.).
For instance, if you have created a GRoboduino variable named "board":
- for initializing the motors you would write: board.initMotors();
- for making a beep sound: board.beep();
etc.

Motors:

Command & Parameters	Result Type	Description
initMotors()	**void**	This is called usually in the "setup" section of the program, when motors will be used. It is absolutely needed for the motor process to work, and ot needs to be called just one time.
setLeftMotor(**int** Speed&Direction)	**void**	Sets the speed and direction of the Left Motor. 1 to 255 on one direction and -1 to -255 on the opposite direction. 0 (zero) stops the motors.
setRightMotor(**int** Speed&Direction)	**void**	Sets the speed and direction of the Right Motor. 1 to 255 on one direction and -1 to -255 on the opposite direction. 0 (zero) stops the motors.
setMotors(**int** Left, **int** Right)	**void**	Sets the speed and direction of both the motors. 1 to 255 on one direction and -1 to -255 on the opposite direction. 0 (zero) stops the motors.
getLeftMotor()	**int**	Returns the current speed and direction of the Left Motor. (-255 to 255, 0 means stopped)
getRightMotor()	**int**	Returns the current speed and direction of the Right Motor. (-255 to 255, 0 means stopped)

LED:

Command & Parameters	Result Type	Description
setLed(**byte** State)	**void**	Sets the state of the led. That can be used in one of the following ways **ON** | **OFF** setLed(**ON**) | setLed(**OFF**) setLed(**true**) | setLed(**false**) setLed(**1**) | setLed(**0**)
toggleLed()	**void**	Turns the led ON if it is OFF and vice-versa.
getLed()	**byte**	Gets the state of the led (pin 13). The evaluation can be done using: ON/OFF, 1/0, true/false. So you can use whatever suits you in your code.

Buzzer:

Command & Parameters	Result Type	Description
beep()	**void**	Makes a single beep sound.
playNote(**char** Note, **int** Duration)	**void**	Plays a musical note (which can be 'c', 'd', 'e', 'f', 'g', 'a', 'b', 'C') for "Duration" milliseconds.
playTone(**int** Tone, **int** Duration)	**void**	Plays "Tone" (in Hz) for "Duration" milliseconds.
playSong(**int** Length, **char** Notes[], **int** Beats[], **int** Tempo)	**void**	Given an array of Notes (characters, 'c', 'd', 'e', 'f', 'g', 'a', 'b', 'C'), an array of beats, the length of those arrays and the tempo, this method plays the sequence of notes as a song.

Other Classes:

Except for the GRoboduino class, in the GRoboduino Library there are also other helpful classes:

class SharpIR:

(SharpIR is a sensor with analog output so it has to be connected to one of the analog ports)

Assuming you have connected your SharpIR sensor on Analog Port 0, there are two ways of creating a SharpIR object:

- Declaring it globally along with the port number

  e.g.:

```
#include "GRoboduinoBoard.h"

SharpIR MySharpIR(0);

void setup()
{

}
```

- Declaring it globally **without** a port number and attaching it to a port inside the "setup" section of your program.

  e.g.:

```
#include "GRoboduinoBoard.h"

SharpIR MySharpIR;

void setup()
{
   MySharpIR.attach(0);
}
```

One way or another, after the initialization, the object is ready to use.
To read the value from the sensor use the “read” command.

e.g.:

```
#include "GRoboduinoBoard.h"

SharpIR MySharpIR(0);

void setup()
{
  Serial.begin(9600);
}

void loop()
{
  Serial.println(MySharpIR.read());
}
```

The result from “read” command is of type int, and it is the result of averaging 10 sensor readings, as the SharpIR sensors have very unstable output.

class ParallaxPing:

(ParallaxPing is a sensor with digital output)

Assuming you have connected your ParallaxPing sensor on Digital Port 3, there are two ways of creating a ParallaxPing object:

- Declaring it globally along with the port number

  e.g.:

```
#include "GRoboduinoBoard.h"

ParallaxPing MyParallaxPing(3);

void setup()
{

}
```

- Declaring it globally **without** a port number and attaching it to a port inside the “setup” section of your program.

  e.g.:

```
#include "GRoboduinoBoard.h"

ParallaxPing MyParallaxPing;

void setup()
{
   MyParallaxPing.attach(3);
}
```

One way or another, after the initialization, the object is ready to use.
To take a measurement you can use the following commands, depending on the result you want:

Command & Parameters	Result Type	**Description**
pingMicroseconds()	**long**	Sends a ping and counts the microseconds to the return of that ping. The result is a long integer of the microseconds counted.
distanceInCM()	**double**	Triggers a measurement and returns the calculated distance, in centimeters, as a double.
distanceInInches()	**double**	Triggers a measurement and returns the calculated distance, in inches, as a double.

e.g.:

```
#include "GRoboduinoBoard.h"

ParallaxPing MyParallaxPing (3);

void setup()
{
  Serial.begin(9600);
}

void loop()
{
  Serial.println(MyParallaxPing.distanceInCM(), DEC);
}
```

APPENDIX

SCHEMATICS